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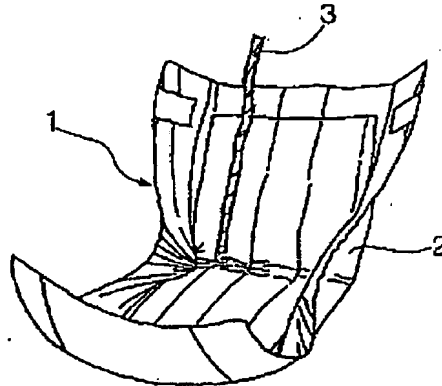
[There are no amendments to this patent.]

**Abstract****Problem**

To present diapers with a urination indicator which allow the presence of urine to be checked visually and detected without the need for checking whether the diapers are wet or not by touching them.

**Means to solve**

Diapers with a urination indicator 1 characterized in that diapers 2 are provided with urination indication means 3 made of a porous layer created by adhering low-refraction pigments, which become transparent to show a different appearance as they absorb fluid, dispersively onto a binder resin.



#### Claims

1. Diapers with a urination indicator, characterized in that they are configured such that a porous layer created by adhering low-refraction pigments dispersively onto a binder resin is provided over the surface of a braid, and a urination indication means where the aforementioned porous layer becomes transparent to present an appearance in a different color as it absorbs urine is attached to the diapers in order to allow urination to be detected visually.

2. The diapers with a urination indicator described under Claim 1, characterized in that one end of the aforementioned urination indication means is positioned near the urination area of the diapers, and the other end is positioned to face outward.

3. The diapers with a urination indicator described under Claim 1 or 2, characterized in that they are configured such that a colored layer is provided as a lower layer below the porous layer, and the aforementioned colored layer becomes transparent as urine discharged is absorbed by the porous layer.

#### Detailed explanation of the invention

[0001]

##### Technical field of the invention

The present invention pertains to diapers with a urination indicator. More specifically, it pertains to diapers with a urination indicator used by an infant, an elderly person, or a patient in which a different appearance than normal is created by urination in order to allow the presence of urine to be detected visually from the outside.

[0002]

Prior art

Several ideas have been proposed pertaining to means to detect the presence of urine (Japanese Kokai Patent Application Nos. Sho 55[1980]-36326, Sho 57[1982]-42901, etc.). In the case of the aforementioned ideas, pigments which change color when a specific pH indicator is applied or in the presence of water have been mentioned. Thus, although coloration or a change of color takes place as [the diapers] become wet, the moisture is absorbed into a urine absorbing member over time, and the pigments are likely to be scattered due to the absorption, resulting in a problem that visual inspection becomes so difficult to achieve that they are not practical.

[0003]

Problem to be solved by the invention

In recent years, diapers have been equipped with a highly absorbent urine absorbing member in order to absorb urine quickly, and they show no changes in terms of outer appearance, making it difficult to detect urination. Therefore, whether they are wet or not needs to be checked by touching them, making it not only inconvenient but also unsanitary. The present invention discloses a new urine detection means which solves the aforementioned problem while making the detection easy.

[0004]

Means to solve the problem

A requirement of the present invention is diapers with a urination indicator which are configured such that a porous layer created by adhering low-refraction pigments dispersively onto a binder resin is provided over the surface of a braid, and a urination indication means where the aforementioned porous layer becomes transparent to present an appearance in a different color as it absorbs urine is attached to the diapers in order to allow urination to be detected visually. Furthermore, other requirements are that one end of the aforementioned urination indication means be positioned near the urinating area of the diapers, and the other end be positioned to face outward, and that they are configured such that a colored layer is provided as a lower layer below the porous layer, and the aforementioned colored layer becomes transparent as urine discharged is absorbed by the porous layer.

[0005]

The present invention takes advantage of the characteristic that the porous layer created by adhering low-refraction pigments dispersively onto a binder resin is opaque in the absence of moisture, and it becomes transparent in the presence of moisture as it absorbs a liquid, such as

water. While the presence of urine can be detected as the aforementioned porous layer changes from opaque to transparent, the detection power can be further improved when a colored layer is provided as a lower layer below the aforementioned porous layer. While the aforementioned colored layer can be provided by means of a printing or a coating means, a base material already colored may also be used.

[0006]

As the aforementioned low-refraction pigments, granular silicate, barite powders, sedimentary barium sulfate, calcium sulfate, clay, talc, alumina white, and basic magnesium carbonate, for example, may be mentioned. Their refraction factors fall in the range of 1.4-1.7, and they show a high level of transparency. Those with a grain size of 0.03-10.0  $\mu\text{m}$  are most suitable, and low-refraction pigments of different kinds may be used at the same time. Fine granular silicate may be mentioned as a most suitable low-refraction pigments since it allows the change from the whitish opaque state to the colorless transparent state to be observed clearly.

[0007]

When fine granular silicate is to be used as a low-refraction pigment, it is desirable to coat it in an amount of 1-30  $\text{g/m}^2$ , or preferably, 5-20  $\text{g/m}^2$ , in order to satisfy both the concealment trait and the transparency when fluid is absorbed, even though they are affected by their characteristics, such as type, grain size, specific surface area, oil absorbency. If it is less than 1  $\text{g/m}^2$ , sufficient concealment is difficult to attain under normal conditions; and if it exceeds 30  $\text{g/m}^2$ , a sufficient level of transparency is difficult to attain when fluid is absorbed. The aforementioned low-refraction pigments are scattered into a vehicle containing a binder resin as a coupling agent, and the porous layer is formed by evaporating the volatile portion after it is coated on a target object.

[0008]

As the aforementioned binder resin, a urethane-type resin, a nylon resin, a vinyl acetate resin, an acrylic ester copolymer resin, an acrylic polyol resin, a vinyl chloride-vinyl acetate copolymer resin, a maleate resin, a polyester resin, a styrene resin, a styrene copolymer resin, a polyethylene resin, a polycarbonate resin, a styrene-butadiene copolymer resin, an acrylonitrile-butadiene copolymer resin, a methyl methacrylate-butadiene copolymer resin, a butadiene resin, a chloroprene resin, a melamine resin, an emulsion of the aforementioned respective resins, casein, starch, a cellulose derivative, polyvinyl alcohol, a urea resin, a phenol resin, and an epoxy resin, for example, may be mentioned. Conventionally known metallic gross pigments, such as mica coated with titanium dioxide, mica coated with iron oxide-titanium

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dioxide, mica coated with iron oxide, guanine, cericite, basic carbonate, acidic arsenate, and bismuth oxychloride, or a common dye and pigments or a fluorescent dye and pigments may be added to the porous layer formed in the aforementioned manner in order to diversify the change of the colors. Furthermore, a material whose colors can be reversed by heat according to changes in the temperature may be included in the porous layer, or a reversible color layer containing a reversible color material may also be provided.

[0009]

A flat or round braid made of acrylic, cotton, polyester, or synthetic fibers of other kinds, or a blend of multiple kinds of fibers, created using a popular conventional braider, such as a braider for flat braids or a braider for round braids, may be used for the aforementioned braid. A braid with a core may also be utilized. In terms of the configuration of the braid, popular conventional 3-strand weaving, 4-strand weaving, 6-strand weaving, 8-strand weaving, 16-strand weaving, 24-strand weaving, and bara-uchi [transliteration] are effective.

[0010]

The porous layer can be formed at desired positions using a printing means, brush coating, or spray coating.

[0011]

Embodiment of the invention

Application examples of the present invention will be described below. The diameter and the length of the braid as the base material of the urination indication means are not restricted to the application examples, and braids of various kinds can be applied to this end. In addition, the aforementioned indication means can be attached to any position which suits a given purpose without being restricted to that shown in the figure.

[0012]

Application examples

Application examples will be shown below. Furthermore, "part" in the application example refers to part(s) by weight.

[0013]

Application Example 1 (Refer to Figure 1)

An aqueous spray ink created by dispersing pink fluorescent pigments into an acryl emulsion was spray-coated over the entire surface of an approximately 3 mm round and 30 cm

long braid to provide a colored layer. Then, an aqueous spray ink created by mixing/agitating fine silica powders (average grain size of secondary particles: approximately 3  $\mu\text{m}$ ), 30 parts urethane resin emulsion (solid content of 50 wt%), 0.2 part dispersant, 0.3 part of antifoaming agent, 2 parts of viscosity modifier, 20 parts water, 5 parts ethyl alcohol, and 5 parts aqueous crosslinking agent was spray-coated and allowed to stand at room temperature. Then, it was dried to cure at 140°C for 3 min to create a porous layer which was white when it was dry and changed to fluorescent pink from white as it absorbed urine in order to obtain urination indication means 3. One end of aforementioned urination indication means 3 was brought into contact with a urine absorbing member of diapers 2, and the other end was placed outwardly so as to allow it to be observed from the outside in order to configure diapers with a urination indicator 1. When aforementioned diapers 1 were actually used, the aforementioned urination indication means 3 in contact with the urine absorbing member changed color from white to fluorescent pink as soon as urine was absorbed into the urine absorbing member. Furthermore, the urine was gradually absorbed outwardly due to capillary action, and the change in color advanced to the other end exposed outside of the diapers after 15 min, allowing the urination by the diaper user to be detected visually from the outside.

[0014]

#### Application Example 2

An aqueous spray ink created by dispersing pink fluorescent pigments into an acrylic emulsion was spray-coated over the surface of the braid in the aforementioned Application Example 1 in the shape of 5 mm long horizontal stripes at approximately 20-mm intervals to create multiple colored layers. Then, as in Application Example 1, an aqueous spray ink created by mixing/agitating 15 parts of fine silica powders, 50 parts urethane resin emulsion (solid content of 35 wt%), 0.2 part dispersant, 0.3 part antifoaming agent, 2 parts viscosity modifier, 20 parts water, 5 parts ethyl alcohol, and 5 parts aqueous crosslinking agent was spray-coated and allowed to stand at room temperature. Then, it was dried to cure at 140°C for 3 min to create a porous layer which was white when it was dry and changed to fluorescent pink from white as it absorbed urine in order to obtain a urination indication means. One end of the aforementioned urination indication means was brought into contact with the urine absorbing member of the diapers, and the other end was placed outwardly so as to allow it to be observed from the outside in order to configure diapers with a urination indicator. When the aforementioned diapers were actually used, the porous layer of the aforementioned urination indication means in contact with the urine absorbing member changed color gradually from white to fluorescent pink as soon as urine was absorbed into the urine absorbing member.



[0015]

Application Example 3

An aqueous screen ink created by evenly mixing/agitating 15 parts of fine silica powders (same as those in Application example 1), 30 parts urethane resin emulsion (solid content of 50 wt%), 0.2 part dispersant, 0.3 part antifoaming agent, 3 parts viscosity modifier, 10 parts water, and 3 parts aqueous crosslinking agent was screen-printed in the axial direction over the entire surface of a 3 mm round and 30 cm long braid colored in blue and allowed to stand at room temperature. Then, it was dried to cure at 130°C for 3 min to create a porous layer which is white when it is dry in order to obtain a urination indication means. When the aforementioned urination detection means was attached in the same manner as that in the aforementioned Application Example 1 for actual use, it changed color gradually from white to blue, and the entire means changed color from white to blue after approximately 15 min.

[0016]

Application Example 4

An aqueous spray ink created by dispersing pink fluorescent pigments into an acrylic emulsion was spray-coated over the entire surface of the aforementioned braid (white) in Application Example 1 to provide a colored layer which extended from one end to the other while leaving an uncoated part of approximately 50 mm in length at one end. Then, an aqueous screen ink created by evenly mixing/agitating 15 parts of fine silica powders (same as those in Application Example 1), 30 parts urethane resin emulsion (solid content of 50 wt%), 0.2 part dispersant, 0.3 part antifoaming agent, 2 parts viscosity modifier, 20 parts water, 5 parts ethyl alcohol, and 5 parts aqueous crosslinking agent was spray-coated over the aforementioned colored layer and allowed to stand at room temperature. Then, it was dried to cure at 140°C for 3 min to create a porous layer which was white when it was dry in order to obtain a urination indication means. When one end where no porous layer was coated on the aforementioned urination indication means was brought into contact with the urine absorbing belt part of the diapers while at least a part of the other end where the porous layer was coated was placed in such a manner that it could be seen from the outside, and [the diapers] were actually used, the tip part of the aforementioned urination indication means absorbed urine as soon as the urine absorbing belt part absorbed a prescribed amount of urine, the urine was gradually absorbed toward the other end due to capillary action, and the other end exposed to the outside of the diapers changed its color from white to fluorescent pink to allow the presence of the urine to be observed visually.

[0017]

**Effect of the invention**

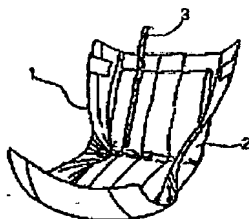
With the diapers with a urination indicator in accordance with the present invention, because the presence/absence of urine can be detected visually from the outside based on whether it changes its color without the need for checking whether the diapers are wet by touching them, it is not only sanitary, but the diapers are always replaced on time.

**Brief description of the figure**

Figure 1 is a diagram for illustrating an application example of the diapers with a urination indicator of the present invention.

**Explanation of symbols**

- 1      Diapers with a urination indicator
- 2      Diapers
- 3      Urination indication means



**Figure 1**